Appendix F

2014 SKM Sewerage Network Analysis

Northern Region 2019 DSP: Future Capital Upgrade Requirements – Northern Sewer Pumping Stations.

Central Coast Council (CCC) has estimated the costs for upgrading its sewer pumping stations for the assets those required upgrade due to the population growth within its northern servicing area for the preparation of the 2019 northern region DSP. This analysis included the current condition pumping run-time analysis and growth based asset requirements for the future condition.

The Northern Sewer Pumping Stations Runtime Investigation identified the sites requiring upgrades and feed them into the 2018 IPART submission. It identified sites with high Inflow-Infiltration and mechanical-electrical issues. This analysis based on information from SCADA Telemetry systems, and PLC control systems, and provided the data required to develop useful information to ensure current performance of the stations. The main task of this project was to determine the median runtimes for each pumping station using SCADA data from July 2015 to January 2018. Further detail of this analysis is presented as an appendix (Northern Sewer Pump Station Runtime Analysis 2018_final v1.docx)

To determine the future asset requirements for 2019 DSP costings, CCC also used the sewer system planning study (CCC and Jacobs, 2013 investigation) to identify future capital upgrade requirements for the northern sewage pumping stations (SPS) and rising mains to service populations growth within the northern operation areas, for a planning horizon of 30 years from year 2013 to 2043. This study provided a forecast of capital upgrade requirements across Council's northern sewerage network. The identified capital works that were included in this project were used as input data for the recalculation of Council's sewerage developer contributions for the 2019 DSP.

At the initial stage, CCC's current SPS median run-time values were populated into the previous SPS Capacity Assessment spreadsheet prepared by Jacobs.

SPS catchment growths were estimated based on 2013 ET (Equivalent Tenements) to 2031 ET for each pumping station as configured in the sewer network (with upstream SPSs). The main objective of this analysis was to compare the number of sites which the theoretical ET assessment deemed as requiring upgrade, against the outcomes of the runtime analysis which is a better indicator of actual loading vs capacity.

The SPS runtime from 2018 were linearly increased with growth from 2019 run time to forecast 2031 runtime. While doing this analysis, the calendar year whenever the pump run time exceeded 4 hrs were highlighted for the 'civil upgrade year' for the pumping station. Also, the pumping stations with high run-time in 2019 were also marked for upgrade. From the linear interpolation, the pumps those would reach more than 4 hrs runtime after 2031 were not included in 2019 IPART costing.

Mechanical/electrical and rising main upgrades for 2013 and 2031 were also highlighted and checked against the historical and ongoing upgrades and were included in the developer charges calculation as appropriate. The outcome was a reduction in the forecast

requirements for sewage pumping station and sewer rising main upgrades compared to the previous theoretical analysis.

Work Package W03- Sewerage System Planning

WASTEWATER CATCHMENT LOAD ASSESSMENTS

- Technical Memorandum
- V2
- 27 March 2014

Sewerage System Planning

WASTEWATER CATCHMENT LOAD ASSESSMENTS

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Contents

Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
1.0- Draft	3/3/14	K. Fung	G. Fisher	4/3/14	Practice Review
2.0	27/3/14	K. Fung	G. Fisher	27/3/14	Deliverable Approval

Distribution of copies

Revision	Date	Quantity	Issued to
1.0- Draft	4/3/2014	1 (email)	J. Zhang (Wyong Shire Council)
2.0	27/3/14	1 (email)	J. Zhang (Wyong Shire Council)

Printed:	27 March 2014
Last saved:	25 March 2014 12:53 PM
File name:	I:\ENVR\Projects\EN04310\Deliverables\Reports\Task 3 and 4- Catchment Loads\EN04310- Catchment Load Assessment Tech Memo v2.0.docx
Author:	P. Bernie
Project manager:	P. Bernie
Name of organisation:	Wyong Shire Council
Name of project:	Sewerage System Planning
Name of document:	Wastewater Catchment Load Assessments
Document version:	2.0
Project number:	EN04310

1. Introduction

1.1. Background

SKM has been engaged to undertake a sewer system planning study to identify future capital upgrade requirements for gravity sewer mains, sewage pumping stations (SPS) and sewage rising mains to service populations growth within Wyong Shire Council's area of operations, for a planning horizon of 30 years from year 2013 to 2043.

The study is required to be completed at a high level for the purpose of providing a forecast of capital upgrade requirements across Council's sewerage network. The identified capital works will be used as input data for the recalculation of Council's water and sewerage developer contributions.

Private pumping stations are not included in the DSP charges, and so are not considered in this memo.

1.2. Purpose of this Memo

The purpose of this technical memo is to assess the capacity of the existing sewerage system, identify assets requiring upgrades in future, and outline plans for servicing new development areas.

The scope of this memo is to estimate current and future loading on the SPS and STPs, and calculate the required capacity and locations for new assets. It involves reviewing the current loading estimates, adding projected growth and assessment of the loads against capacity.

1.3. Reference Documents

A number of documents were referenced in a review of current best practice for the estimation of wastewater flow and the population forecast. These are:

1. Sewerage Code of Australia, WSA 02—2002-2.3, Hunter Water Edition, Version 1, December 2009

2. Sewerage Code of Australia, WSA 02—2002-2.2, Sydney Water Edition, Version 3, July 2009

3. Technical Memo- Wastewater Loading Rate Assumptions for Wyong Shire, Version 4, SKM, December 2013

2. SPS and STP Capacity Assessment

2.1. Introduction

Council currently operates six sewage treatment plants (STPs). Schematics defining which SPS are in the catchment of each STP are provided in **Appendix A**. The schematics also show which SPS are upstream of other SPS, and which SPSs pump directly to the STPs. Proposed SPSs have been included on these schematics, as well as proposed diversions of rising mains.

Maps showing the location of existing sewerage assets are provided in **Appendix B**. The sewerage assets have been overlaid on the SPS catchment boundaries, contours, Local Environment Plan (LEP) land zoning and the expected locations of development. The proposed asset upgrades, for inclusion in the capital works program, have also been noted on these maps. The SPS upgrades are based on a capacity assessment. The calculations of this assessment are provided in the spreadsheet in **Appendix C**.

The capital works program for sewerage assets (gravity mains, pumping stations and rising mains) has been included in **Appendix D**.

2.2. Development Areas

Council provided a table of greenfield development sites and the planned number of dwellings in each site. They also provided tables with projections for town centres, infill growth and strategy areas. Id consulting provided GIS files with the location of planned development sites. Council also provided maps with the location, timing and ET load projected for commercially and industrially zoned areas. Using the maps in **Appendix B**, and considering the SPS catchment boundaries in particular, the loads from each development site, town centre, infill area and strategy development area were allocated to a specific SPS catchment.

Where a development precinct is serviced by more than one SPS, the SPS was allocated based on the approximate catchment area based on the existing contours. Some development areas will require a new SPS where draining to an existing SPS by gravity is not feasible. Where new SPS are required it was assumed that these will be standard wet-well stations with submersible-pumps. Alternative approaches, such as low pressure or vacuum sewerage can be considered in future detailed assessment.

It was assumed that any greenfield area not included in the development table or commercial/industrial load maps will not have any development until after the year 2043.

2.3. Asset Capacity Assessment Method

Council has provided data for the existing (mechanical, electrical and rising main) and ultimate (civil) capacity of the existing SPS. Where SPS capacity was provided in terms of flow (L/s) only, the equivalent tenement (ET) load was back-calculated.

The ET loads within each catchment were taken from the 2006 DSPs.

Based on the schematic layouts (**Appendix A),** upstream SPS loads were added to the downstream SPS or STP. The development area was allocated to each SPS. This was done for three time steps, 2013, 2031 and 2043. Negligible commercial development was assumed from 2006-2013.

The commercial/industrial zoned area within each existing SPS catchment was calculated. The area value was multiplied by the ET/Ha rates from the previous Technical Memorandum to estimate the ultimate non-residential wastewater ET potential for the current LEP. Based on examination of developed land area in recent aerial photography it was estimated how much of the non-residential potential is included in the 2006 DSP ET values. It was assumed that the remaining commercial/industrial area within the current SPS catchments will be developed by 2031. Wastewater loads from the greenfield commercial areas were also added. It was assumed that growth in commercial development after 2031 will occur at the same rate as population growth within the SPS catchments with existing commercial land use and the areas.

Based on the assumed growth rates for each social planning district, refer **Table 1**, the 2043 loads were calculated. It was assumed that this growth will predominately occur within the catchments of the SPS that are constructed by 2031.

Table 1. Population Average Annual Growth Rate Assumed for Planning Purposes, 2031-2043

Social Planning District	(% p.a.)	(Additional Population per Annum)
Gorokan SPD	0.61%	133.9
Northern Lakes SPD	2.56%	410.8
Ourimbah - Rural South SPD	0.51%	24.7
Rural West SPD	0.48%	9.7
San Remo - Budgewoi SPD	0.09%	18.4
Southern Lakes SPD	0.13%	33.0
The Entrance SPD	1.10%	367.4
Toukley SPD	0.64%	72.1
Warnervale - Wadalba SPD	3.85%	1487.8
Wyong SPD	0.91%	190.7
Grand Total	**1.35%**	**2748.5**

2.4. STP Capacity Assessment

To assess whether STP upgrades are required at each time-step the estimated future STP load was subtracted from the current / future STP capacity. The results are provided in **Table 2**, which include the proposed diversion of WS16 to the Charmhaven STP catchment. The results indicate that by 2043 only Bateau Bay STP will have significant spare capacity. Council could consider re-diverting the rising main load from WS34 (2122 ET in 2043) to BB01, perhaps via BB04 and BB03,

by comparing the cost of the new rising main and additional SPS upgrades to a Wyong South STP capacity upgrade.

- **Table 2. STP Capacity Assessment in ET**

STP	STP Current Capacity (ET)	Planned STP Future Capacity (ET)	STP Load 2013 (ET)	Spare Capacity 2013 (ET)	STP Load 2031 (ET)	Spare Capacity 2031 (ET)	STP Load 2043 (ET)	Spare Capacity 2043 (ET)
Bateau Bay	32,000	32,000	17,613	14,387	21,072	10928	23,207	8793
Charmhaven	16,667	25,000	14,907	1,760	28,498	-11832	32,989	-16322
Gwandalan	5,000	5,000	2,799	2,201	3,895	1105	5,092	-92
Mannering Park	5,000	5,000	4,745	255	5,997	-997	7,839	-2839
Toukley	17,250	17,250	13,992	3,258	15,609	1641	16,605	645
Wyong South	20,000	25,000	15,285	4,715	17,848	2152	19,088	912
Total	**95,917**	**109,250**	**69,341**		**92,920**		**104,821**	

- **Table 3. STP Capacity Assessment in EP**

STP	STP Current Capacity (EP)	Planned STP Future Capacity (EP)	STP Load 2013 (EP)	Spare Capacity 2013 (EP)	STP Load 2031 (EP)	Spare Capacity 2031 (EP)	STP Load 2043 (EP)	Spare Capacity 2043 (EP)
Bateau Bay	76,800	76,800	42,271	34,529	50,573	26227	55,698	21102
Charmhaven	40,000	60,000	35,777	4,223	68,396	-28396	79,174	-39174
Gwandalan	12,000	12,000	6,718	5,282	9,348	2652	12,220	-220
Mannering Park	12,000	12,000	11,388	612	14,393	-2393	18,814	-6814
Toukley	41,400	41,400	33,581	7,819	37,462	3938	39,853	1547
Wyong South	48,000	60,000	36,684	11,316	42,836	5164	45,812	2188
Total	**230,200**	**262,200**	**166,418**		**223,007**		**251,570**	

2.5. SPS Capacity Assessment

To assess whether SPS mechanical/electrical upgrades are required at each time-step the calculated incoming peak wet weather flow (PWWF) was subtracted from the pumping capacity, and a negative value indicates that the SPS over-loaded. **Appendix C** contains the calculations of the SPS capacity assessment.

To assess whether the load on a SPS exceeds its civil capacity, the required wet-well diameter was calculated and compared to the actual diameter. In calculating the required wet-well diameter a

maximum permitted pump start frequency of 8 starts per hour and typical operating depth, as detailed in **Table 4**, was assumed, since actual operating depth data was not available. Typical operating depth for a SPS is defined as distance from 200mm below the invert of the incoming sewer to the pump cut-out level.

- **Table 4. Assumed SPS Operating Depths**

SPS ET capacity	Assumed Operating Depth
Greater than 9000*	1.5m
7500 and 9000*	1.4m
5680 and 7500*	1.3m
4240 and 5680	1.2m
2800 and 4240	1. 1m
Less than 2800	1.0m

* Larger diameters stations are expected to provide additional flexibility for capacity upgrades, and so where the results of the assessment suggests that they are just over capacity, we have assumed the upgrade may not be immediately required. This can be re-considered in future detailed analysis.

Note that with this analysis, some SPS are calculated to be already overloaded in 2013, and so any additional development loading triggers an upgrade. Before a station is confirmed to be upgraded, a more detailed assessment should be conducted to review the particular dimensions and capacities of the assets.

Where no development is predicted it is assumed that no upgrade is required.

Where a rising main upgrade is required, and the existing rising main alignment is appropriate, it was assumed that the existing rising main will remain in service to operate in parallel with the new main to amplify the flow capacity. The pressure rating or condition of the existing rising mains was not considered.

For preliminary sizing of the new gravity sewer mains for new development areas, the values in **Table 5** were adopted, which assume an average wastewater generation of 200L/d/ET, and the absolute minimum grades from the Hunter Water version of the Sewerage Code of Australia. This approach is conservative as the same size pipe with a steeper grade (such as to meet the self-cleansing grade or to follow the topography) can accept flow from more ET. The diameters could be revised once more information is available, such as road and lot layouts, and finish surface level plans for the sites.

- **Table 5. Pipe Diameters and Capacities**

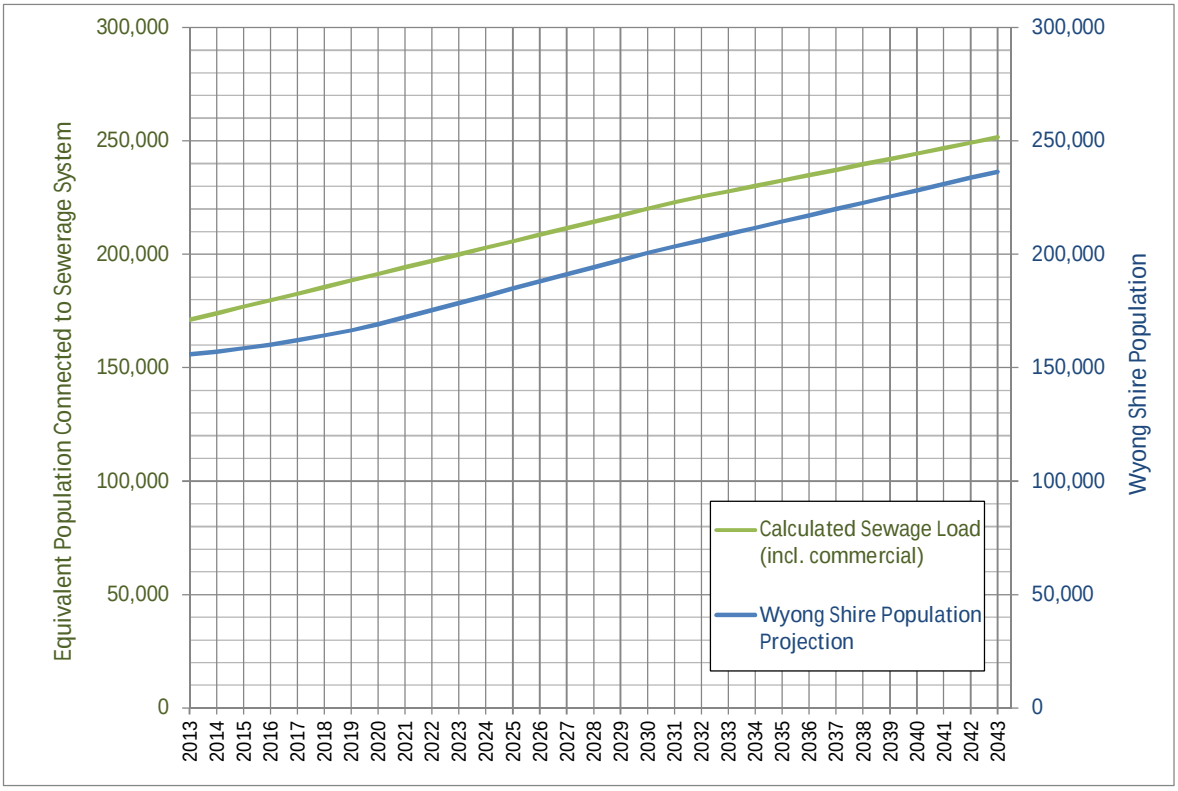
Pipe Diameter (DN)	Minimum Grade (%)	Pipe Capacity (L/s)	Pipe Capacity (ET)
150	0.5	11.7	155
225	0.33	28.1	385
300	0.25	52.4	735
375	0.19	82.4	1170
450	0.15	119	1700
525	0.15	166	2390
600	0.15	236	3400

The values in **Table 5** were also used in assessment of whether the load on the gravity sewers exceed the capacities, and so require upgrading.

2.6. Check for consistency against shire-wide population projection

Figure 1 shows the shire-wide population projection and the estimated wastewater load. The difference in the values is mostly due to commercial wastewater generation. The two sets of data values are considered consistent.

Figure 1. Calculated Load on the Sewerage System and Population Projection 2013 to 2043



2.7. Capital Works Programme

The assets to be upgraded and constructed between 2013 and 2043 and the capital costs are detailed in Appendix D.

Asset upgrades include:

- SPS- civil and/or mechanical/electrical components
- Rising mains, including diversions
- Gravity sewers of diameter DN225, and greater diameters

For cost estimating purposes it was assumed that the gravity sewer mains will be laid at the grades in **Table 6**, or at a greater slope where the ground profile allows. These grades were used in calculating the depth at which the gravity mains will be laid. It was also assumed that the minimum depth of cover for a gravity sewer will be 1.2m. An allowance of 0.15m for pipe bedding below the invert level was made.

The grades in **Table 6** were selected so that an average fluid velocity of at least 0.7m/s is achieved within the sewer main at peak dry weather flow (PDWF) for the ultimate development condition, so

that the main is self-cleansing. This corresponds to a fluid velocity of at least 0.88m/s at peak wet weather flow (PWWF), with the sewer flowing full.

- **Table 6. Assumed Sewer Grades for Cost Estimation**

Pipe Diameter (DN)	Grade (%)	Grade (1 in)
150	1.10	91
225	0.62	161
300	0.42	238
375	0.31	322
450	0.25	400
525	0.21	476
600	0.17	588

It has been assumed that rising mains will be laid in a 1.5m-3.0m depth range. No detailed assessment has been made.

Council provided the following unit rates for cost estimation (**Table 6**, **Table 7** and **Figure 2**) which were used for cost estimation. They advise that these include factors for council requirements and client costs.

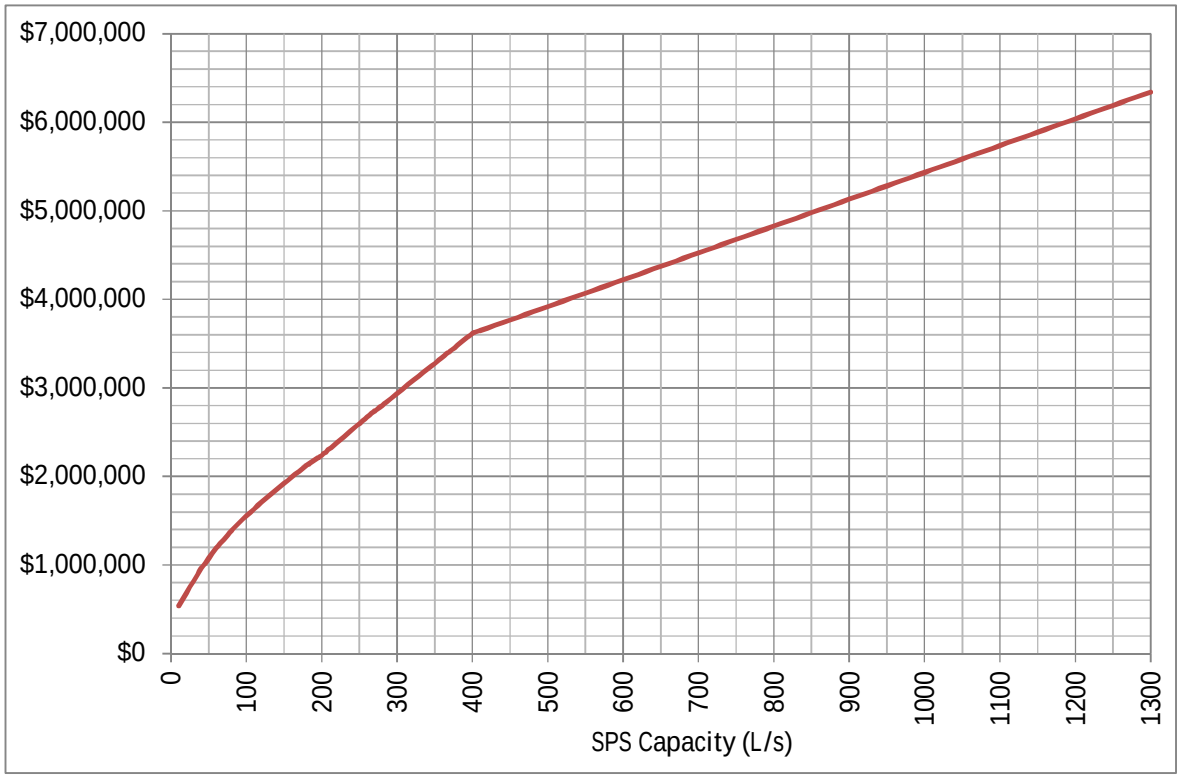
- **Table 6. Gravity Sewer Main Unit Rates**

	Rate per metre		
Diameter (DN)	1.5-3m Depth	3-4.5m Depth	> 4.5 m Depth
225	$463	$571	$684
300	$571	$704	$807
375	$725	$837	$950
450	$868	$991	$1,094
500	$1,010	$1,145	$1,256
600	$1,299	$1,299	$1,401
750	$1,452	$1,565	$1,678

- **Table 7. Rising Main Unit Rates**

Diameter (DN)	Rate per metre
100	$280
150	$321
200	$444
250	$491
300	$542
375	$660
450	$772

- **Figure 2. SPS Unit Rates**



The SPS unit rates in **Figure 2** are for submersible type pumping stations with low pumping heads (up to 50m).

Council's advice that the SPS unit rate breakdown is 60% mechanical/electrical and 40% civil works has been adopted. This breakdown has been applied where estimating the cost of upgrade to part of an existing asset.

It was assumed that where an SPS upgrade is required there is no residual value in the existing asset component, that is, full replacement will be undertaken. This is considered valid since the upgrades will often be timed for when the existing equipment is due for replacement due to wear and tear, and that the existing equipment often does not meet current standards and requirements.

Appendix A Network Layout

Appendix B Sewerage Plans

Appendix C SPS Capacity Assessment Spreadsheet

Appendix D Capital Works Program

Work Package W03- Sewerage System Planning

WASTEWATER LOADING RATE ASSUMPTIONS FOR WYONG SHIRE

- Technical Memorandum
- Final
- 8 April 2014

Sewerage System Planning

WASTEWATER LOADING RATES

- Final
- 8 April 2014

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Contents

Document history and status

Revision	Date issued	Reviewed by	Approved by	Date approved	Revision type
1	29/11/13	K Fung	K Fung	29/11/13	Practice Review
3	10/12/13	K Fung	G Fisher	12/12/13	Practice Review
4 (Final)	30/1/14	G Fisher	G Fisher	30/1/14	PD Review
5 (Final)	8/4/14	G Fisher	G Fisher	8/4/14	PD Review

Distribution of copies

Revision	Copy no	Quantity	Issued to
2	1	1 (email)	J Zhang (Wyong Shire Council)
3	1	1 (email)	J Zhang (Wyong Shire Council)
4 (Final)	1	1 (email)	J Zhang (Wyong Shire Council)
5 (Final)	1	1 (email)	J Zhang (Wyong Shire Council)

Printed:	7 April 2014
Last saved:	7 April 2014 04:52 PM
File name:	I:\ENVR\Projects\EN04310\Deliverables\Reports\Task 2- Design Flows\EN04310-Wastewater Generation Rates 140407 v5.docx
Author:	P. Bernie
Project manager:	P. Bernie
Name of organisation:	Wyong Shire Council
Name of project:	Sewerage System Planning
Name of document:	Wastewater Loading Rates
Document version:	Final
Project number:	EN04310

1. Introduction

1.1. Background

SKM has been engaged to undertake a sewer catchment study to identify future capital upgrade requirements for gravity sewer mains, sewage pumping stations (civil, mechanical and electrical), sewage rising mains and sewage treatment plant upgrades to service populations growth within Wyong Shire Council's area of operations, for a planning horizon of 30 years from year 2013 to 2043.

The study is required to be completed at a high level for the purpose of providing a suitable forecast of capital upgrade requirements across Council's sewerage network. The identified capital works will be used as input data for the recalculation of Council's water and sewerage developer contributions.

1.2. Purpose of this Memo

The purpose of this technical memo is to recommend and document the wastewater generation rates to be used when undertaking sewerage system planning, for the sake of developing a capital works program for future augmentations and system extensions. The sewerage system planning will involve assessing the capacity of the existing sewerage system, planning for capacity upgrades to the existing system, and planning for servicing of new development areas, all of which involve the estimation of future wastewater flows.

This document provides Council with the opportunity to review and comment on the assumptions and method to be used for estimation of wastewater flows.

1.3. Scope

The scope of this memo is to review the current practice for the estimation of average dry weather flow for existing tenements and new (water efficient) development as part of sewerage system planning.

The scope is also to review Council's existing land use Equivalent Tenement wastewater generation rates table and suggest amendments for the purpose of estimating current and future connection loads, which will be undertaken as part of the current project.

This memo also details the population projection that will be used in checking the calculated residential equivalent population (EP).

1.4. Reference Documents

A number of documents were referenced in a review of current best practice for the estimation of wastewater flow and the population forecast. These are:

1. Developer Charges Guidelines for Water Supply, Sewerage and Stormwater, 2012 – Consultation Draft, NSW Office of Water, August 2012

2. Sewerage Code of Australia, WSA 02—2002-2.3, Hunter Water Edition, Version 1, December 2009

3. Sewerage Code of Australia, WSA 02—2002-2.2, Sydney Water Edition, Version 3, July 2009

4. Gosford City Council Gosford Master Planning Project, Technical Memorandum for TM04-Population Forecast, October 2011.

2. Review of Wastewater Generation Rates Used by Local Water Utilities

For planning purposes local water utilities in NSW typically adopt a method for wastewater flow estimation which is based on Equivalent Tenements (ET) or Equivalent Population (EP). Historically Wyong Shire Council has used this approach for wastewater flow estimation, with one ET counted for each general residential lot. An ET value is estimated for non-residential development based on the estimated average daily wastewater flow (ADWF). The total number of sewerage ETs is the sum of the residential ETs and the non-residential ETs.

The ET method makes an allowance for sanitary flow, measured as ADWF for each ET, applies a peaking factor (r) to give peak flow and adds a storm allowance (SA) to estimate the peak wet weather flow (PWWF). This provides an approach for estimating wastewater flows without requiring the use of calibrated computer models and/or sewer flow gauging. The calculated ADWF and PWWF values are then available for use in assessing the capacity of existing infrastructure and for the design of new infrastructure.

The objective of wastewater flow estimation is to construct sewerage infrastructure which is appropriately sized for the catchment area and number of properties it is to service. Different water utilities use slightly different input values to these calculations. Local water utilities adjust their assumptions based on various factors which include:

- The size of the catchment area to be serviced.
- The number of properties to be serviced.
- The type of development and land use.
- The rate of wastewater generation for the different development types and land uses within the area, which is related to the water consumption and types of usage.
- The expected performance of the sewerage system in preventing stormwater and groundwater from entering the sewerage system
- The expected amount of rainfall.
- Calibration of assumptions based on gauging of wastewater flows in existing systems.

There has been a trend of increasing water efficiency in households and industry. This has been due to a number of factors, including the introduction of pricing tariffs which are based on the volume of water consumed; increased use of more water efficient appliances; and BASIX requirements which apply to new residential properties and significant renovations. In response to these factors, the wastewater generation rates applied by utilities have been reduced over time.

Another trend is that modern sewerage networks are constructed using longer lengths of flexible pipe with flexible joints (such as PVC), which have a lower level of groundwater infiltration compared with older vitreous clay pipes, which are shorter, have more joints and are brittle, and so more prone to cracking due to ground movement or tree roots.

Table 1 contains the wastewater generation rates for a typical residential dwelling which are currently used by Wyong Shire Council, Hunter Water and Sydney Water for high-level sewerage system planning purposes. These are local, independent water utilities. Sydney Water currently adopts a lower wastewater generation rate than Wyong Shire Council, and Hunter Water a slightly higher rate.

The potable water supply target under BASIX is 150L/person/d, which is typically achieved by supplying non-potable water usage (such as toilet flushing, washing machines, garden watering and car washing) from a rainwater tank, and installing water efficient fittings and appliances. The wastewater contribution from a BASIX compliant property is approximately 200L/EP/d, which is greater than the 150L/EP/d potable water consumption target due to the non-potable uses that discharge to the sewerage system. It should be noted that the biological and suspended solids load (which is the load on a wastewater treatment plant) from a house is not covered by BASIX requirements. Also to note is that the water efficiency of a dwelling could decline over time if less water efficient appliances are installed in the home.

Also in **Table 1** is the wastewater generation rate recommended by NSW Office of Water, which is based on metered ADWFs of 200L/EP/d at sewage treatment works in non-metropolitan NSW. This represents a mix of pre- and post-BASIX dwellings.

Also in **Table 1** are the assumed occupancy rates (EP/ET) used by the local utilities. Wyong Shire Council assumes a lower EP/ET than other utilities, and it is recommended that this is not reduced further as it already provides efficiently sized assets. For comparison, the id population forecast average people per dwelling for planning districts is provided in **Table 2.** The overall average of 2.32 people per dwelling within Wyong Shire is within 5% of the currently adopted EP/ET value of 2.4.

Based on this review of the current practice for the estimation of ADWF, a value of 200L/EP/d and 0.0056L/s/ET is recommended for the purposes of sewerage system planning for forecasting capital upgrade requirements for greenfield development sites. It is recommended that this value is only applicable to new (water efficient) development. It is based on a wastewater generation rate of 200L/EP/d, as per the NSW Office of Water recommendation. This is a lower rate than currently used by Council, and the rationale for the change is to take into account the increased water efficiency. A range of PWWF values are recommended, between 0.069L/s/ET and 0.080L/s/ET, depending on the attenuation based on the size of the catchment, which will be used for sizing new sewer mains.

For existing development it is recommended to continue to assume 240L/EP/d, and 0.0067L/s/ET for the purposes of sewerage system planning, as was used for the previous DSPs. This is due to the majority of properties within Wyong Shire being constructed prior to BASIX being implemented in 2004, and so it is expected that they will on average have lower water efficiency.

Presented in the right hand column of **Table 1** are the input values that were used to calculate these recommended values. The EP/ET rate and storm allowance are the same as currently used by Council. The range of the resulting PWWF values is slightly lower than the existing range used by Wyong Shire Council, and is at the lower end of the range used by Hunter Water and towards the upper end of the range used by Sydney Water.

Table 1. Wastewater Generation Rates

Assumption	Wyong Shire Council (current)	NSW Office of Water recommendation	Hunter Water	Sydney Water	Suggested for use in system planning for development sites
WW Generation (L/EP/d)	240	200	270	180	200
Occupancy (EP/ET)	2.4	2.6	3.5	3.5	2.4
ADWF (L/ET/d)	576	520	945	630	480
ADWF (L/s/ET)	0.0067	0.0060	0.0109	0.0073	0.0056
r ** (smallest catchment)	4.0	4.0	4.0	4.0	4.0
r ** (largest catchment)	1.9	1.9	1.9	1.9	1.9
PDWF (small catchment) (L/s/ET)	0.027	0.024	0.044	0.029	0.022
PDWF (large catchment) (L/s/ET)	0.013	0.011	0.021	0.014	0.011
SA (small catchment) (L/s/ET)	0.058	0.058	0.058	0.058*	0.058
SA (large catchment) (L/s/ET)	0.058	0.058	0.058	0.028*	0.058
PWWF (small catchment) (L/s/ET)	0.085	0.082	0.102	0.088	0.080
PWWF (large catchment) (L/s/ET)	0.071	0.069	0.079	0.042	0.069

* As Sydney Water does not use a method with fixed storm allowance, the SA values were calculated based on PWWF = 3 x PDWF.

** The actual “r” value to be used will be a function of the number of ET in the catchment

- **Table 2. Residential Population Per Dwelling (2013), from the id Population Projection**

Social Planning District	People Per Dwelling
Gorokan SPD	2.33
Northern Lakes SPD	2.17
Ourimbah - Rural South SPD	2.75
Rural West SPD	2.43
San Remo - Budgewoi SPD	2.39
Southern Lakes SPD	2.61
The Entrance SPD	1.86
Toukley SPD	1.95
Warnervale - Wadalba SPD	3.01
Wyong SPD	2.52
Overall for Wyong Shire	**2.32**

3. Proposed Calculation Methodology

3.1. Proposed Methodology

The proposed method for estimating existing loadings (current year 2013) on each SPS and treatment plant is to use the ET load estimates for the year 2006 from the 2006 DSPs, and add the increase in load due to greenfield development sites, infill growth and town centre developments that has occurred since 2006, together with an allowance for new commercial development. The same method will be used for projecting the wastewater loads for the period 2013- 2031. That is:

2043 ET Load on SPS = Year 2006 load from 2006 DSP **+** Greenfield Development Sites, Infill, Town Centre and Strategy Area growth, from 2012 development assumptions table **+** Commercial allowance where not already included **+** Allowance for population growth 2031-2043

The expected additional dwellings in specific greenfield residential development sites has been provided by Council for the period 2007-2031, and so this can be used directly. The expected additional dwellings due to infill growth and town centre developments has been provided by Council for the period 2010-2031, and so will be projected back for the period 2007-2010.

For projecting the potential commercial wastewater load a method based on land zoning and typical wastewater loading rates, in ET/Ha, will be used. The land zoning categories to be used will be based on the draft 2013 Local Environment Plan (LEP). The area of commercial land zonings will be multiplied by typical commercial loading rates, to give an estimate of the potential ultimate load. Council also advised the timing and infrastructure sizing for greenfield commercial development sites, and these are to be added to the wastewater load projections.

As the forecast data beyond 2031 is not available, Social Planning District (SPD) wide growth rates will be projected from the id forecast data, giving a prediction of the lots per year to be serviced beyond 2031. For projecting the residential wastewater load for the period 2031-2043, where the annual growth rate for an area is relatively modest (say, less than 1.5%), a method based on applying the annual growth rate across each catchment will be used.

For those catchments where the growth rate is high, this is due to development of greenfield sites which have not reached their potential land usage, and so the growth will be allocated to these based on wastewater load density for the growth sites. The 2031 ET estimate for the greenfield sites will be divided by the area of residential land zoning. Those with lowest (less than 10 ET/Ha for low density, less than 15 ET/Ha for general residential and less than 20ET/Ha for medium density residential) will be flagged as having potential to accept more growth. The projected population for 2031-2043 will then be allocated to those areas.

An example trial case to test this loading calculation method is provided in **Appendix A.** The development assumptions data is provided in **Appendix B**.

3.2. Wastewater Loading Rates

Part of this project's scope is to review Council's existing wastewater generation rates table and suggest amendments for the purpose of estimating current and future wastewater loads. Council's existing wastewater contribution table consists of many factors which require detailed inputs (for example number of beds per hotel, basins per hairdresser or the floor area of an office). These type of factors are suitable when this information is available, such as when calculating the wastewater load from a specific development proposal or trade waste application which is to be serviced by a particular diameter of pipe at a certain grade, but are of limited use when seeking to undertake a high level assessment of the whole shire.

For this study wastewater flow estimates only need to have enough detail to estimate future capital expenditure requirements. For this reason it is proposed to use wastewater contribution factors based on land zoning to estimate wastewater loads for the period 2031-2043. The proposed rates are presented in **Sections 3.2.1** and **3.2.2**. Development is expected to change over time, and so flow estimates based on land use zoning rather than existing specific developments is appropriate, particularly for long-term estimates.

Council's existing detailed contribution factors can be applied for future detailed planning, once the specific details of a development proposal are known and a design for the assets are required.

With this proposed method the calculated wastewater load estimates can be adjusted where more detailed information is available, particularly for large commercial and industrial sites, which are often unique, and so not well represented by general loading rates based on land zoning.

3.2.1. Residential Loading Rates

The proposed residential wastewater loading rates are listed in **Table 3**.

Based on Reference 2, a typical wastewater loading rate for low density zoning is 10ET/Ha and for medium density zoning is 25ET/Ha. These values were set as target loading rates, and then adjusted so that the resulting population matches the id forecast population projection. The medium density and general residential zoning loading rates were adjusted within a range of 15 to 25 ET/Ha. The people per dwelling rates in **Table 2** were used to convert the population to an ET value for each SPD.

- **Table 3. 2013 Population Estimates for Social Planning Districts and Corresponding Residential Wastewater Loading Estimates**

		Residential Area with Sewer Connections (Ha)			Wastewater Loading Rate (ET/Ha)			Residential Wastewater Loading (ET)		
SPD	Id 2013 populat-ion	Medium Density Zoning	General Zoning	Low Density and Enviro Living Zonings	Medium Density Zoning	General Zoning	Low Density and Enviro Living Zonings	Medium Density Zoning	General Zoning	Low Density and Enviro Living Zonings
Gorokan	19822	0.0	241.3	460.0	-	15	10.6	0	3620	4879
Northern Lakes	15489	0.0	80.2	415.4	-	20	13.4	0	1603	5546
Ourimbah - Rural South	4681	0.0	68.7	32.8	-	20	10.0	0	1374	328
San Remo - Budgewoi	20689	0.0	165.4	513.2	-	20	10.4	0	3309	5348
Southern Lakes	25857	0.0	67.4	664.2	-	20	12.9	0	1347	8562
The Entrance	26601	119.7	369.0	374.4	20	20	12.0	2394	7381	4502
Toukley	9348	38.7	80.5	214.3	20	20	11.2	774	1610	2410
Warnervale - Wadalda	15441	0.0	16.6	477.7	-	20	10.0	0	333	4797
Wyong	15815	30.7	149.9	355.5	20	15	9.6	615	2248	3422
Wyong Shire	**153744**	**189.1**	**1239.1**	**3507.4**	20	18.4	11.3	3783	22825	39754

3.2.2. Wastewater Loading for Non-Residential 2013 LEP Land Zonings

Unlike the growth in residential population, no annual projection for commercial and industrial type wastewater loading is available. For planning purposes, representative wastewater loading rates (ET/Ha) values will be assumed. The "general industrial" loading is based on the rate in Reference 2 for multi-purpose industrial land zoning, and the other are assumed to have similar wastewater loadings as for low density residential. These are presented in **Table 4**.

Table 4. Trial ET for Non-residential 2013 LEP Land Zonings

Land Zoning (2013 LEP Categories)	Assumed Wastewater Loading Rate (ET per Gross Area (Ha))
Business Development	10
Business Park	10
Commercial Core	10
Enterprise Corridor	10
Environmental Conservation	Negligible
Environmental Management	Negligible
General Industrial	30
Infrastructure	Negligible
Light Industrial	10
Local Centre	10
Mixed Use	10
National Parks and Nature Reserves	Negligible
Neighbourhood Centre	10
Private Recreation	Negligible
Public Recreation	Negligible
Recreational Waterways	Negligible
Tourist	10
Transition	Negligible

3.3. Population Projection

The majority of population growth is predicted to be accommodated in new dwellings in greenfield sites. As development occurs new wastewater assets will be required to service the greenfield areas. Many of these assets will be sized for ultimate loading. The estimate of ultimate loading will be based on wastewater loading for each zoning type within each greenfield development site boundary.

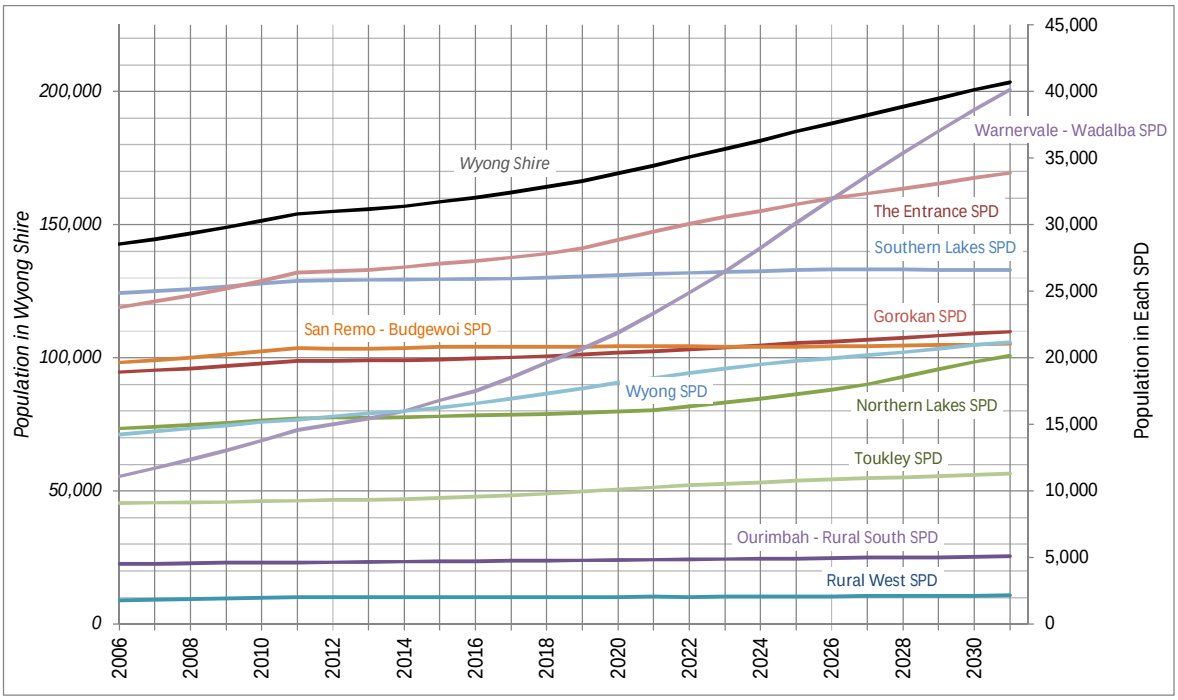
The actual construction of the assets will occur in a staged manner. The development of the sewerage capital works program will be guided by Council's development assumptions spread-sheet. Refer **Appendix B**.

Residential population projections for Social Planning Districts (SPD) were obtained from the website prepared for Wyong Shire by ".id" consulting:
http://forecast2.id.com.au/Default.aspx?id=254&pg=5000

The population forecast data that was obtained is presented in **Figure 1**. According to the website these forecasts were updated with 2011 Census based population estimates, and were last reviewed on 12 July 2012. This forecast is up to 2031, and so for beyond 2031, it is necessary to extrapolate the population forecasts

The districts of major projected population growth are the Warnervale-Wadalba, The Entrance, Northern Lakes and Wyong SPDs.

- **Figure 1. Population Projection, by Social Planning District, from id**



For extrapolating the population projection beyond 2031, the average annual population growth rate was calculated, in both person per annum and as a percentage annual growth rate for three time periods:

- 2030-2031
- 2026-2031
- 2021-2031

The calculated average annual growth rates are presented in **Table 5** and **Table 6**.

- **Table 5. Population Annual Growth Rates (people p.a)**

Social Planning District	2030-2031 (Additional Population per Annum)	2026-2031 (Additional Population per Annum)	2021-2031 (Additional Population per Annum)
Gorokan SPD	133.9	145.8	146.0
Northern Lakes SPD	470.8	511.2	410.8
Ourimbah - Rural South SPD	28.7	25.4	24.7
Rural West SPD	13.1	11.9	9.7
San Remo - Budgewoi SPD	38.7	36.0	18.4
Southern Lakes SPD	-8.3	-3.6	33.0
The Entrance SPD	367.4	381.2	438.6
Toukley SPD	72.1	87.3	102.4
Warnervale - Wadalba SPD	1487.8	1641.2	1677.4
Wyong SPD	190.7	237.2	264.9
Grand Total	**2795.0**	**3073.6**	**3125.9**

- **Table 6. Population Annual Growth Rates (% p.a.)**

Social Planning District	2030-2031 (%)	2026-2031 (%)	2021-2031 (%)
Gorokan SPD	0.61%	0.69%	0.71%
Northern Lakes SPD	2.39%	2.90%	2.56%
Ourimbah - Rural South SPD	0.57%	0.51%	0.51%
Rural West SPD	0.61%	0.57%	0.48%
San Remo - Budgewoi SPD	0.18%	0.17%	0.09%
Southern Lakes SPD	-0.03%	-0.01%	0.13%
The Entrance SPD	1.10%	1.19%	1.49%
Toukley SPD	0.64%	0.80%	1.00%
Warnervale - Wadalba SPD	3.85%	5.14%	7.18%
Wyong SPD	0.91%	1.19%	1.43%
Grand Total	**1.39%**	**1.63%**	**1.82%**

For the current purpose of sewerage system planning a population projection is required up until 2043. Since a population projection for this time period is unavailable a methodology for projecting the population was developed. This is based on extrapolating the population growth rate, assuming a constant increase in population for each year beyond 2031, for each SPD. **Table 7** contains the growth rates that will be used for extrapolating the population projection. These were selected after considering the population projection that was developed as part of the Gosford Master Planning Project (Reference 4), which extends until 2051. The resulting population projection is provided in **Figure 2**, with the extrapolated population projection shown as dashed lines.

It is proposed to apply these growth projections to estimate the increase in wastewater loading dues to population growth for the period beyond 2031-2043, where information on greenfield development sites is currently unavailable.

Table 7. Population Average Annual Growth Rate Assumed for Planning Purposes, 2031-2043

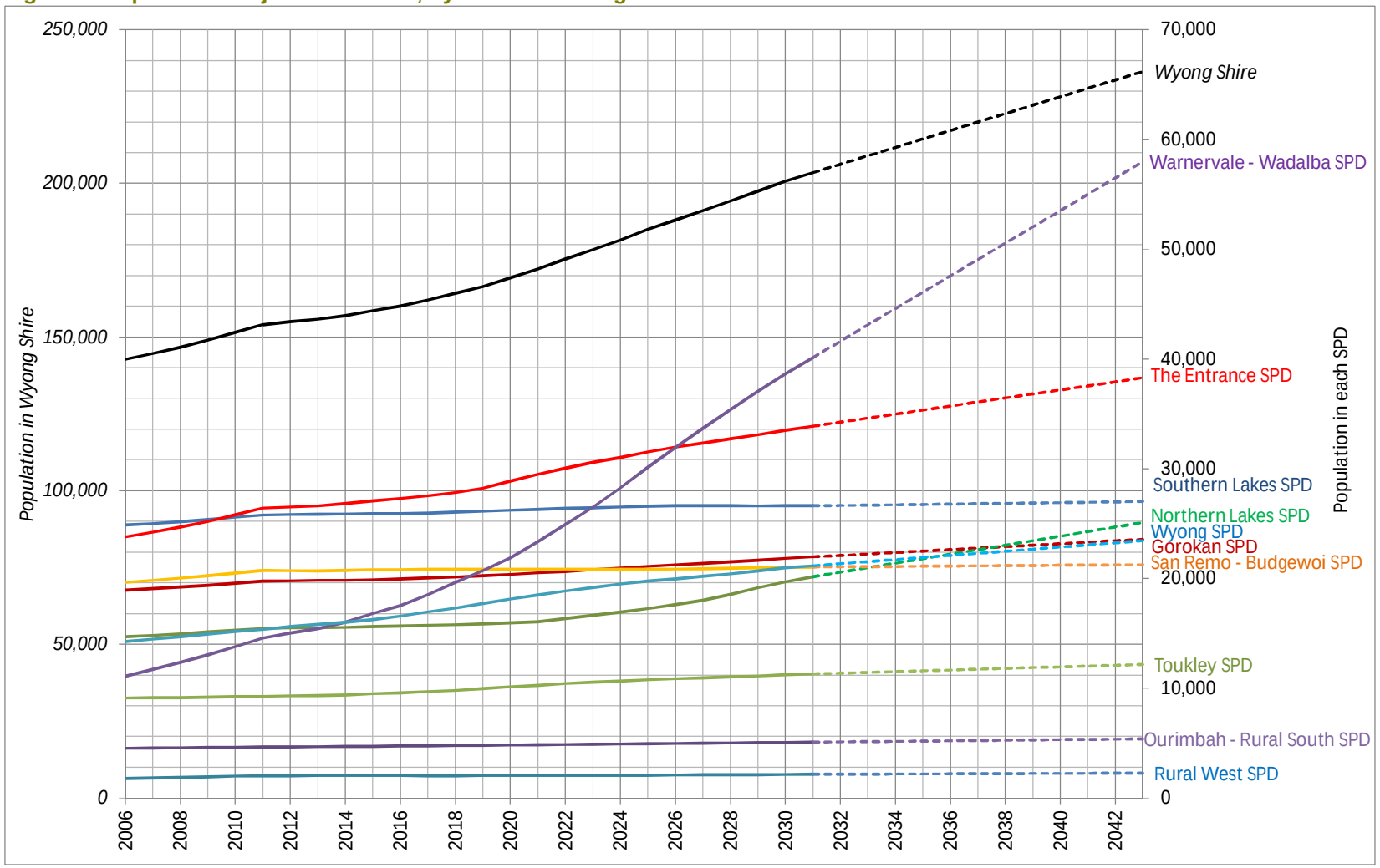
Social Planning District	(% p.a.)	(Additional Population per Annum)
Gorokan SPD	0.61%	133.9
Northern Lakes SPD	2.56%	410.8
Ourimbah - Rural South SPD	0.51%	24.7
Rural West SPD	0.48%	9.7
San Remo - Budgewoi SPD	0.09%	18.4
Southern Lakes SPD	0.13%	33.0
The Entrance SPD	1.10%	367.4
Toukley SPD	0.64%	72.1
Warnervale - Wadalba SPD	3.85%	1487.8
Wyong SPD	0.91%	190.7
Grand Total	**1.35%**	**2748.5**

As a check, the population projection values were divided by the residential land zoning areas in the 2013 LEP, to calculate the population density, and this is presented in **Table 8**. Using the 2013 draft LEP zonings, the Warnervale-Wadalba SPD has an excessively high density. As shown in **Appendix C**, this is due to some of the large development sites not yet being rezoned from Environmental Conservation and Transition to residential-type land use. Development Precincts 2, 3, 6 and 8 will provide an additional 554Ha of land to be rezoned, and if included in the Warnervale-Wadalba SPD as residential area, the resulting population density is 54.4 people/Ha. A similar concept applies to the other SPD, with future rezoning having the potential to increase the residential zoning area, and to higher density development.

- **Table 8. Population Density**

Social Planning District	Residential Land Zoning	2013	2031	2043
	Ha	People/Ha	People/Ha	People/Ha
Gorokan	703.4	28.2	31.2	33.5
Northern Lakes	492.0	31.5	41.0	51.0
Ourimbah - Rural South	102.0	45.9	49.9	52.8
San Remo - Budgewoi	684.3	30.2	30.7	31.1
Southern Lakes	719.6	35.9	37.0	37.5
The Entrance	866.2	30.7	39.1	44.2
Toukley	337.3	27.7	33.5	36.1
Warnervale - Wadalda	511.9	30.2	78.4	113.3
Wyong	544.7	29.0	38.8	43.0
Wyong Shire	**4961.3**	**31.4**	**41.0**	**48.0**

Figure 2. Population Projection to 2043, by Social Planning District



Appendix A Trial Wastewater Loading Calculation

The sub-system of sewage pumping stations B14, B15 and B16 was used as a trial to test the data and proposed wastewater loading calculation methodology.

A.1 Year 2006 load from 2006 DSP

It is assumed that the greenfield development site off Bellevue Road will be loaded onto B16, refer **Appendix C**. From the development assumptions spread-sheet, the ultimate number of dwellings for this site is 405, which assumes 16.7 dwellings/Ha, which is consistent with General Residential zoning. The first dwellings are predicted in 2017, and so do not affect the 2013 wastewater load.

Bateau Bay town centre is assumed to be within the B16 catchment. This has a potential for 8 new dwellings/year.

The Bateau Bay villages fall within the B13 and B01G catchments.

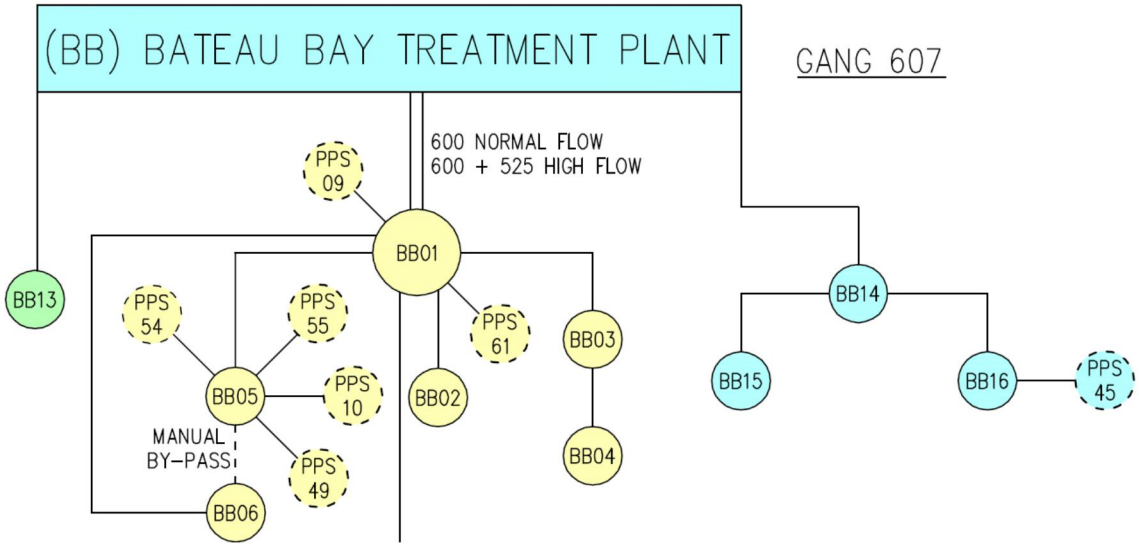
Bateau Bay Infill is 10 new dwellings/year. This is assumed to be 3 dwellings/year within B16 and 3 dwellings/year within B14, 3 dwellings/year within B01 and 2 dwellings/year in B13.

These values, together with loadings from the Development Servicing Plan No 3, The Entrance District, 2006, are presented in **Table 9**.

A.2 Sewerage Network

Schematics showing the sewerage network were supplied by Council. An example schematic is shown in **Figure 3**. The area and connections for “upstream” SPS (B15 and B16) are added to the “downstream” SPS (B14) to calculate the total load on the downstream SPS.

- **Figure 3. Example Sewerage Network Schematic (from WSC)**



An example of this loading calculation is provided in **Table 9**, which totals the wastewater loadings as per the connectivity in the **Figure 3** schematic.

The calculated total loadings will be compared to the SPS capacities as advised by Council, or used to size new assets for development areas which are currently un-serviced. The capacity of the example SPS (BB14, BB15 and BB16) are provided in **Table 9**. For this example, using the methodology as described, predicts that all the SPS will require future upgrades.

Table 9. Trial Wastewater Loading Calculation

		PS B15	PS B16	PS B14
2006 Loading	(ET)	140	1,790	727
Growth to 2013	Greenfield	-	-	-
Growth to 2013	Town Centre	8 p.a.	-	-
Growth to 2013	Infill	-	3 p.a.	3 p.a.
Area	Business Development Area (Ha)	1.16	-	0.78
Area	Local Centre (Ha)	9.53	-	-
Area	Neighbourhood Centre (Ha)	-	0.83	-
Area	Light Industrial (Ha)	-	0.47	-
Rate	ET/Gross Ha	10	10	10
Commercial Potential	(ET)	107	11	8
Non-Residential Development Assumption		Fully Developed	Fully Developed	Fully Developed
2013 Loading	(ET)	196	1,811	748
Growth to 2031	Greenfield	-	405	-
Growth to 2031	Town Centre	-	8 p.a.	-
Growth to 2031	Infill	-	3 p.a.	3 p.a.
2031 Loading	(ET)	196	2,414	802
Projected growth 2031-2043	(% p.a.)	1.10%	1.10%	1.10%
Additional ET 2031-2043		26	319	106
2043 Loading	(ET)	222	2,733	908
Upstream SPS		-	-	BB15, BB16
Loading due to upstream SPS	(ET)	-	-	2955
Total Loading 2043	(ET)	222	2,733	3,863
SPS Capacity 2013	(ET)	234	2,368	2,639

Appendix B Development Assumptions Spreadsheet

Appendix C Sewerage System and Draft LEP Maps